Biological Monitoring

Kentucky's biological monitoring program currently consists of a network of 33 stations in 11 river basins. Data collected from these stations are used to ensure that existing water quality is maintained, provide background values against which future water quality conditions can be compared, and recognize emerging problems in the areas of toxic residue, bacteriological contamination and nuisance biological growth. Program emphasis is directed at evaluating warmwater aquatic habitat (WAH) use support instream, determining presence and concentration of toxic residues in fish tissue and sediments, and evaluating municipal and industrial effluents for toxic conditions. The information from these monitoring efforts supports EPA's Basic Water Monitoring Program, provides information to state programs, and is used in developing the 305(b) report. For this report, biological data from 33 sites sampled from 1984-1987 were used to assess 948.2 miles of streams for the WAH use. Biological monitoring station locations and parameter coverage are outlined in Table 38.

Intensive Surveys

Kentucky uses the intensive survey to evaluate site-specific water quality problems. Information developed from intensive surveys are essential in providing a technical basis to:

- Document the attainment/impairment of designated water uses,
- Verify and justify construction grants decisions,
- Address issues raised in petitions for water quality standard variances, or use redesignations, and
- Document water quality improvements and progress resulting from water pollution control efforts.

In 1986-1987, four intensive surveys were conducted on 267 miles of streams. The locations, purposes, and conclusions of these surveys are summarized in Table 39. During the 1988/1989 fiscal year, at least six intensive surveys are planned. Table 40 lists the locations and the objectives of each survey.

Aquatic Life/Human Health Toxicity Testing

The Commonwealth of Kentucky has enacted several regulations for the protection of aquatic life in receiving waters. These regulations, for the most part, are based on setting effluent limitations for individual chemicals. However, toxicity data are available for only a limited number of compounds. Single parameter protection criteria, therefore, does not provide adequate or correct protection of aquatic life in certain situations: where the toxicity of the components in the effluent or surface waters is not known; where there are synergistic (greater than predicted) or antagonistic (less than predicted) effects between toxic substances in the tested media; or where a complete chemical characterization of the water has not been carried out. Since it is not economically feasible to determine the toxicity of each of the thousands of potentially toxic substances in surface waters or point-source effluents, the most direct and cost-effective approach is whole-effluent or surface water analysis of toxicity in a standard bioassay.

Assessment of the extent, presence and control of toxic conditions in the Commonwealth has relied on chemical specific and whole-effluent monitoring for

Table 38
Biological Monitoring Station Locations and Sampling Coverage (1986-1987)

Station	U.S.G.S Hydrologic Unit No.	Algae	Macro-invertebrates	Fish	Fish Tissue	Sediments
Big Sandy River Basin						
Tug Fork	05070201	X	X			X
Levisa Fork	05070203	X	X		X	X
Little Sandy River Basin						
Little Sandy River	05090104					X
Ohio River Basin						
Kinniconick Creek	05090201	X	X			X
Tygarts Creek	05090103					X
Licking River Basin						
North Fork Licking River	05100101	X	X			X
Licking River-Sherburne	05100101	X	X			X
Licking River-Salyersville	05100101	X	X	X	X	X
South Fork Licking River	05100102	X	X			X
Kentucky River Basin						
North Fork Kentucky River	05100201	X	X			X
Middle Fork Kentucky River	05100202	X	X			X
South Fork Kentucky River	05100203	X	X			X
Kentucky River, Lock 14	05100204	X	X			X
Red River	05100204	X	X	X	X	X
Kentucky River, Camp Nelson	05100205	X	X			X
Kentucky R. below Frankfort	05100205	X	X		X	X
South Elkhorn Creek	05100205	X	X			X
Eagle Creek	05100205	X	X			X

Table 38 (continued)

Station	U.S.G.S Hydrologic Unit No.	Algae	Macro-invertebrates	Fish	Fish Tissue	Sediments
Upper Cumberland River Basin						
Rockcastle River	05130102	X	X	X	X	X
Horse Lick Creek	05130102	X	X			X
Green River Basin						
Nolin River	05110001	X	X	X	X	X
Bacon Creek	05110001	X	X			X
Green River - Munfordville	05110001	X	X			X
Green River - Morgantown	05110003				X	
Barren River	05110002					X
Mud River	05110003	X	X		X	X
Salt River Basin						
Salt River	05140102	X	X			X
Pond Creek	05140102	X	X			X
Beech Fork	05140103	X	X	X	X	X
Rolling Fork	05140103	X	X			X
Tradewater River Basin						
Tradewater River	05140205	X	X			X
Tennessee River Basin						
Clarks River	06040006	X	X		X	X
Mississippi River Basin						
Bayou de Chien	08010201	X	X			X

X - indicates monitored parameters

Table 39
List of Intensive Surveys
Conducted During FY 86 and FY 87

Hydrologic Unit Number/Stream	Purposes of Survey	Total Miles Assessed	Miles Supporting Uses	Miles Partially Supporting Uses	Miles Not Supporting Uses	Conclusions
05100205						
Elkhorn/North Elkhorn Cr. System	To establish background water quality and biological data prior to major industrial development.	156.6	154.6	2	0	At present this stream system supports diverse aquatic life and has good water quality.
*Cedar Brook/ Bailey Run	To assess the impact of an industrial discharge and to determine if PCBs were entering the stream system from an abandoned dump site.	7	3	1.5	2.5	The industrial discharge has severely degraded aquatic life and water quality. No PCBs were found in the stream system
05130104						
Little South Fork Cumberland River	To determine the impact of surface coal mining and oil well drilling on the aquatic life and water quality.	53.4	0	53.4	0	Both surface mine and oil well operations have degraded the water quality and negatively impacted the stream's aquatic li
06040006						
Tennessee River/ Cypress Creek	To determine the impact of the Calvert City industrial complex on the water quality and aquatic biota of the Tennessee River and Cypress Creek system.	50.4	30.9	0	19.5	Some toxicity was occurring nea industrial discharges in the Tennessee River. Aquatic life and water quality were degraded in the lower ten miles of Cypres Creek. Channelizing the creek has resulted in the loss of many forms of aquatic life due to habitat elimination.
	TOTAL	267.4	188.5	56.9	22	

*This stream does not appear on the U.S.G.S. Hydrologic Unit Map.

Table 40
Proposed Intensive Surveys for FY 88 and FY 89

Hydrologic Unit Number/Stream	Objective	Type of Study
05070201 - 05070204 Big Sandy River Basin	1986 305(b) report indicated levels of fecal coliform bacteria were in excess of water quality criteria for recreational use. Survey to determine recreational potential and problem areas in Big Sandy Basin.	Bacteriological and Water Quality Survey
05100202 Cutshin Creek, Kentucky River Basin	To attempt to locate the source of periodic fish kills (study recommended in the 1986 305(b) report).	Full Intensive Survey
05100205 Eagle Creek, Kentucky River Basin	To acquire baseline water quality and biological data prior to future industrial and urban development.	Full Intensive Survey
05130101 Yellow Creek, Cumberland River Basin	To determine if the newly completed Middlesboro WWTP is adequately treating the municipal waste. This is a follow-up survey of a study done in 1982.	Full Intensive Survey
05130104 Rock Creek, Cumberland River Basin	To determine the effect of clear cutting activities in the headwaters and acid mine pollution in the lower portion of the drainage.	Full Intensive Survey
05130206 Little River, Lower Cumberland River Basin	To establish baseline water quality and biotic conditions in support of a nonpoint source pollution evaluation study and to validate low altitude photography as an assessment technique for targeting priority management areas.	Full Intensive Survey

municipal and industrial discharges under the Kentucky Pollution Discharge Elimination System (KPDES) permit process, compliance biomonitoring on those point-source dischargers, quarterly toxicity analysis (bioassays) of surface waters from the 45 primary network stations, and toxicity testing of sediments and surface waters associated with intensive surveys. Under the KPDES permitting program, most major industrial and municipal facilities, and a number of minor facilities discharging priority pollutants, will be required to conduct toxicity testing (acute or chronic) on their final effluent(s).

During 1986-87, acute and chronic toxicity tests were conducted by the Division of Water on 46 point source discharges and on instream locations above and below those sources. In addition, 45 primary network stations and 56 locations associated with intensive surveys received toxicity testing. Stream miles impacted by point and nonpoint source pollutants totalled 1,084 miles. Impacts assessed by river basin are listed in Table 41.

The chemical-specific approach has been used to control toxics for the protection of human health. Generally, levels of protection for public water supplies rely on the 10^{-6} risk level (one additional cancer death in one million people). Fish consumption advisories have relied on the presence in fish fillets of concentrations that are greater than U.S. Food and Drug Administration action levels for poisonous or deleterious substances in human food.

Sediments

Toxicity assessments of sediments were made at 66 sites with 96-hour fathead minnow sediment-elutriate and/or 9-day embryo-larval solid-phase sediment toxicity tests. Since sediments act as "sinks" for many pollutants, toxicity demonstrated in such testing may be reflective of years of low-level substance buildup or brief highly toxic discharges.

Toxicity was determined at 53 (80%) of the sites assessed. A toxic response was observed at ten sites that did not show similar water column toxicity. However, at no site that was nontoxic in sediment tests was water-column toxicity seen. Further analyses of this data, such as correlations with benthic community structure at sample sites, need to be conducted to relate the results to impacts on stream use support.

Citizens Water Watch Program

The Kentucky WATER WATCH program is administered by the Natural Resources and Environmental Protection Cabinet's Division of Water. Launched in 1985, WATER WATCH promotes individual responsibility for a common resource, educates Kentuckians about the wise use and protection of local water resources, provides a recreational opportunity through group activities, and gives citizens more access to their government. Objectives include: promoting individual responsibility for a common resource by fostering a public role in drawing attention to specific problem situations; enhancing citizen understanding and support through a strong program of public education; and communicating the value of environmental quality in attracting industry and tourism to the state. The Division of Water promotes the program by encouraging citizens to form groups which "adopt" waterbodies of local interest.

After a group is formed, members identify the stream, lake or wetland they want to adopt and submit an "adoption" form for approval to the Division of Water. After the adoption is approved, the WATER WATCH group then promotes community awareness and protection of their adopted water resource through stream monitoring, school based programs and stream rehabilitation projects.

Table 41
Stream Miles Impacted by Toxic Discharges
Based on the Results of Toxicity Tests

Basin	Stream(s) Affected	Miles Impacted	Probable Cause
Green River			
	Town Branch	4.0	PCBs
	Mud River	64.7	PCBs
	*Barren River	6.5	Nonpoint
	*Green River	31.1	Pb, nonpoint
	*Rough River	59.0	Fe, nonpoint
	*Pond River	52.4	pH, Mn, Fe, nonpoint
	Total	217.7	
Kentucky River			
	Town Branch	12.0	Chlorine, nonpoint, ammonia, BOD
	South Elkhorn Creek	24.5	Chlorine, ammonia, BOD, nonpoint
	Royal Springs	1.0	Chlorine
	North Elkhorn Creek	5.0	Chlorine
	Cedar Brook	3.5	Metals, cyanide
	Bailey Run	1.5	Metals, cyanide
	*North Fork Kentucky River	8.6	Pb, nonpoint
	*Kentucky River	88.6	Ammonia,chlorine,Fe,Pb, nonpoint
	Jessamine Creek	5.0	Chlorine, ammonia
	Town Branch (Wilmore)	2.0	BOD, nonpoint
	Lee's Branch (Midway)	1.0	Chlorine
	Town Branch (Mt. Vernon)	2.0	Chlorine, ammonia, BOD
	Brushy Fork (Berea)	2.0	Chlorine, ammonia, BOD
	Walnut Meadows Creek	2.0	Chlorine, ammonia, BOD
	White Oak Creek	2.0	Chlorine, ammonia, BOD
	Logan Creek	2.0	Chlorine, ammonia, BOD
	Judy Creek	2.0	Chlorine, ammonia, BOD
	Swift Creek	2.0	Chlorine, ammonia, BOD
	*Red River	41.0	Nonpoint, Fe, chloride
	*Dix River	44.6	Nonpoint, Pb
	*Eagle Creek	27.2	Fe, nonpoint
	Clarks Run	2.0	Chlorine, BOD, ammonia
	Total	281.5	

Table 41 (continued)

Basin	Stream(s) Affected	Miles Impacted	Probable Cause
Licking River			
	Brushy Fork	2.5	Chloride, chlorine
	*Licking River	37.2	Nonpoint
	*Licking River (Salyersville)	76.4	Mn, nonpoint, chloride
	Strodes Creek	5.0	Metals, chlorine, BOD, ammonia, nonpoint
	Total	121.1	
Big Sandy River			
	*Tug Fork	56.0	Fe, pH, nonpoint
	*Levisa Fork	60.0	Fe, nonpoint
	Total	116.0	
Cumberland River			
	*Cumberland River	75.0	Fe, nonpoint
	*Buck Creek	30.0	Nonpoint
	*Horse Lick Creek	21.0	Nonpoint
	Total	126.0	
Tradewater River			
	*Tradewater River	29.9	Mn, Cd, nonpoint
	Total	29.9	
Tennessee River			
	Cypress Creek	8.0	Chlorine, nonpoint, organics
	Tennessee River	2.0	(B.F. Goodrich barge slip) Multiple industrial
	Total	10.0	

Table 41 (continued)

Basin	Stream(s) Affected	Miles Impacted	Probable Cause
Salt River			
	*Pond Creek	21.8	Nonpoint, multiple industrial, chlordane
	*Beech Fork	13.6	Nonpoint
	Town Creek (Harrodsburg)	2.0	Chlorine, ammonia, BOD
	Total	37.4	
Mississippi River			
	*Mayfield Creek	30.2	Fe, nonpoint
	Total	30.2	
Ohio Basin			
	*Little Sandy River	39.3	Zn, Mn, nonpoint
	*Tygarts Creek	75.0	Nonpoint
	Total	114.3	
	State Total	1,084.1	

*Locations in which the specific toxic component is unknown or can be attributed to nonpoint sources is indicated by asterisk.

Each group receives training from the division's program coordinator, along with educational resources which includes a WATER WATCH Program Manual and two field guides (A Field Guide to Kentucky's Lakes and Wetlands and A Field Guide to Kentucky's Rivers and Streams).

Since its beginning, over 150 groups have been established with more than 800 members statewide, and over 22,000 people have received an overview presentation telling them about the program. One hundred and twenty-four streams, seventeen lakes, eight wetlands and seven karst or underground systems have been adopted. Over 70 basic training workshops have been held in conjunction with the program statewide. Advanced training workshops for volunteers are also offered from time to time.

The Kentucky Division of Water has received inquiries from Texas, Wisconsin, Pennsylvania, New Jersey, New York, Tennessee, Colorado, Mississippi, Alabama, Arkansas, Washington, West Virginia, and South Carolina about establishing similar volunteer programs in their state. The program gained international recognition when it received the North American Environmental Education Association's 1987 award for outstanding service to environmental education.

Volunteer Stream Monitoring Project

To assist local groups in developing information concerning the quality of water resources close to them, and to gather information about stream segments not covered by the existing Kentucky Ambient Water Quality Monitoring Network, the WATER WATCH Program has recruited over 60 volunteer teams to conduct regular water quality tests on streams in their communities. Although the information obtained cannot be used in enforcement action, citizen monitoring can and has provided useful "flagging" of water quality problems.

The teams are equipped with commercial water testing kits for measuring dissolved oxygen, pH, temperature, nitrate-nitrogen, ortho-phosphate, sulfate, iron and chloride. Volunteers are trained in testing and reporting procedures and how to interpret results. Training also involves discussing ways the information can be shared through various organizations and media outlets.

Recruited groups have agreed to perform monthly tests on at least two designated sites in their community for one year. The volunteers submit the results to the division, usually within one week after the tests are performed. The results are tabulated, summarized and reported back to the groups.

The project is producing site data from 57 stations on Kentucky streams. The program is administered on a continuing basis by the WATER WATCH Program Coordinator at the Division of Water as a part of the overall WATER WATCH Program. New sites are being added continuously. Often, local groups, civic organizations, schools, and businesses contribute to the project.